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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
MURPHY, RHONDA L	

ART UNIT	PAPER NUMBER
2462	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/788,657	SHAO ET AL.	
	Examiner	Art Unit	
	RHONDA MURPHY	2462	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 16 November 2009.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 30-44 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 30-44 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 27 February 2004 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

1. This office action is responsive to the communication filed on 11/16/09. Accordingly, claims 1-29 have been canceled and claims 30-44 are currently pending.

Response to Arguments

1. Applicant's arguments, see pages 8-9, filed 11/16/09, with respect to the rejection(s) of claims 30, 35 and 40 under 35 USC 103(a) have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of a new prior art reference.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to

consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

3. Claims 30 - 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gowrisankar, "A Rate-one Full-diversity Low-complexity Space-Time-Frequency Block Code (STFBC) for 4-Tx MIMO-OFDM" in view of Giannakis et al. (US 7,224,744).

Regarding claims 30 and 35, Gowrisankar teaches an apparatus (*Fig. 1*) comprising: a diversity agent to receive content for transmission via a multicarrier wireless communication channel (*space-time-frequency encoder*), wherein the received content is a vector of input symbols (s) of size Nc x 1, wherein Nc is the number of subcarriers of the multicarrier wireless communication channel (*page 2, left column, section B: Nc subcarriers*), and to generate a rate-one, space-frequency code matrix from the received content for transmission on the multicarrier wireless communication channel from a plurality of more than two transmit antennae (*page 1, right column, first paragraph; also described on page 3, left column, Section III*).

Gowrisankar fails to explicitly disclose dividing the vector of input symbols into a number G of groups to generate subgroups and multiplying at least a subset of the subgroups by a constellation rotation precoder to produce a number G of pre-coded vectors (vg), wherein successive symbols from the same group transmitted from the same antenna are at a frequency distance that is multiples of NG subcarrier spacings.

However, Giannakis teaches dividing the vector of input symbols into a number G of groups to generate subgroups and multiplying at least a subset of the subgroups by a constellation rotation precoder to produce a number G of pre-coded vectors (Vg)

(*col. 9, lines 1-15; col. 10, lines 15-23*), wherein successive symbols from the same group transmitted from the same antenna are at a frequency distance that is multiples of NG subcarrier spacings (*col. 10, lines 24-42*).

In view of this, it would have been obvious to one skilled in the art to divide the symbols into groups and multiply by a constellation rotation precoder, in order to achieve maximum space path diversity order (Giannakis: col. 10, lines 45-53).

Regarding claims 31 and 36, the combined system of Gowrisankar and Giannakis teach a system according to claim 40. Gowrisankar further teaches the diversity agent further comprising: a space-frequency encoding element, responsive to the pre-coder element, to divide each of the pre-coded vectors into a number of LM x 1 subvectors, and to create an M x M diagonal matrix = Dsg,k = diag{ΘTM×(k-1)+1Sg ,..., ΘTMxkSg }, where k=1...L from the subvectors (page 3, left column, section C, first paragraph).

Regarding claims 32 and 37, the combined system of Gowrisankar and Giannakis teach a system according to claim 40. Giannakis further teaches a system according to claim 41, wherein the space-frequency encoding element interleaves the L submatrices from the G groups to generate an M x Nc space-frequency matrix (col. 9, lines 32-55).

Regarding claims 33 and 38, Gowrisankar teaches a system according to claim 42, wherein the space-frequency matrix (col. 12, lines 44-50) provides MNL channel diversity, while preserving a code rate of 1 for any number of transmit antenna(s) M, receive antenna(s) N and channel tap(s) L (col. 12, lines 51-63).

Regarding claims 34 and 39, Gowrisankar teaches a system according to claim 40, wherein the space-frequency matrix (col. 12, lines 44-50) provides MNL channel

diversity, while preserving a code rate of 1 for any number of transmit antenna(s) M, receive antenna(s) N and channel tap(s) L (col. 12, lines 51-63).

4. Claims 40 – 44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gowrisankar, "A Rate-one Full-diversity Low-complexity Space-Time-Frequency Block Code (STFBC) for 4-Tx MIMO-OFDM" in view of Giannakis et al. (US 7,224,744) and Csapo et al. (US 6,801,788).

Regarding claim 40, Gowrisankar teaches a system (*Fig. 1*) comprising: a number M of antennas, wherein M comprises more than two antennas (*see Fig. 1*); and a diversity agent, to receive content for transmission via a multicarrier wireless communication channel (*space-time-frequency encoder*), wherein the received content is a vector of input symbols (s) of size Nc x 1, wherein Nc is the number of subcarriers of the multicarrier wireless communication channel (*page 2, left column, section B: Nc subcarriers*), and to generate a rate-one, space-frequency code matrix from the received content for transmission on the multicarrier wireless communication channel from at least a subset of the M bi-directional antennas (*page 1, right column, first paragraph; also described on page 3, left column, Section III*).

Gowrisankar fails to explicitly disclose dividing the vector of input symbols into a number G of groups to generate subgroups and multiplying at least a subset of the subgroups by a constellation rotation precoder to produce a number G of pre-coded vectors (vg), wherein successive symbols from the same group transmitted from the same antenna are at a frequency distance that is multiples of NG subcarrier spacings.

However, Giannakis teaches dividing the vector of input symbols into a number G of groups to generate subgroups and multiplying at least a subset of the subgroups by a constellation rotation precoder to produce a number G of pre-coded vectors (Vg) (*col. 9, lines 1-15; col. 10, lines 15-23*), wherein successive symbols from the same group transmitted from the same antenna are at a frequency distance that is multiples of NG subcarrier spacings (*col. 10, lines 24-42*).

In view of this, it would have been obvious to one skilled in the art to divide the symbols into groups and multiply by a constellation rotation precoder, in order to maximize spatial diversity.

Gowrisankar fails to explicitly disclose omnidirectional antennas.

However, Csapo teaches omnidirectional antennas (*col. 1, lines 49-54*). In view of this, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Gowrisankar's system to include omnidirectional antennas, for the purpose of enabling the antennas to transmit and receive signals in all directions.

Regarding claim 41, the combined system of Gowrisankar and Giannakis teach a system according to claim 40. Gowrisankar further teaches the diversity agent further comprising: a space-frequency encoding element, responsive to the pre-coder element, to divide each of the pre-coded vectors into a number of LM x 1 subvectors, and to create an M x M diagonal matrix = Dsg,k = diag{ΘTM×(k-1)+1Sg ,..., ΘTMxkSg }, where k=1...L from the subvectors (page 3, left column, section C, first paragraph).

Regarding claim 42, the combined system of Gowrisankar and Giannakis teach a system according to claim 40. Giannakis further teaches a system according to claim 41, wherein the space-frequency encoding element interleaves the L submatrices from the G groups to generate an M x Nc space-frequency matrix (col. 9, lines 32-55).

Regarding claim 43, Gowrisankar teaches a system according to claim 42, wherein the space-frequency matrix (col. 12, lines 44-50) provides MNL channel diversity, while preserving a code rate of 1 for any number of transmit antenna(s) M, receive antenna(s) N and channel tap(s) L (col. 12, lines 51-63).

Regarding claim 44, Gowrisankar teaches a system according to claim 40, wherein the space-frequency matrix (col. 12, lines 44-50) provides MNL channel diversity, while preserving a code rate of 1 for any number of transmit antenna(s) M, receive antenna(s) N and channel tap(s) L (col. 12, lines 51-63).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to RHONDA MURPHY whose telephone number is (571)272-3185. The examiner can normally be reached on Monday - Friday 9:00 - 5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Seema Rao can be reached on (571) 272-3174. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Seema S. Rao/
Supervisory Patent Examiner, Art Unit 2462

Rhonda Murphy
Examiner
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Examiner, Art Unit 2462